

Ocean Color Data at the Goddard Earth Sciences (GES) DAAC

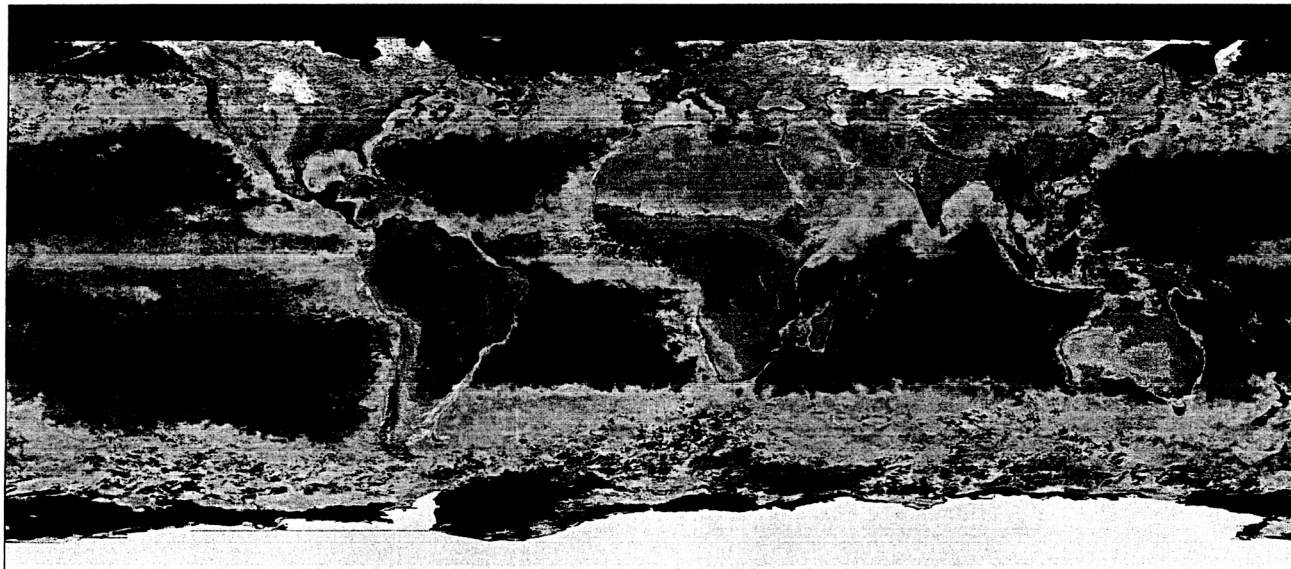
CZCS, SeaWiFS, OCTS, MODIS-Terra, MODIS-Aqua

Distributed Active Archive Center (DAAC)



September 2002

SeaWiFS Global Biosphere, December 2000



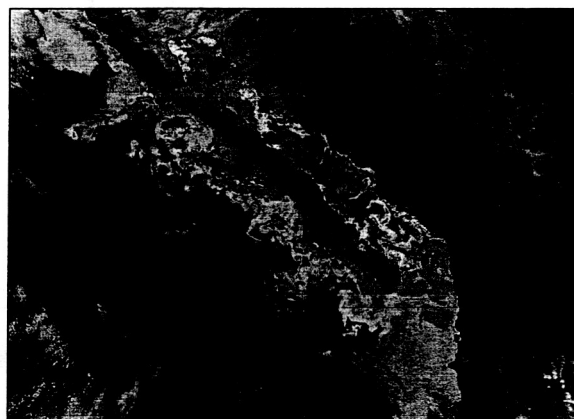
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The apparent color of the ocean is determined by the interactions of incident light with substances or particles present in the water. The most significant constituents are free-floating photosynthetic organisms (phytoplankton) and inorganic particulates. Phytoplankton contain chlorophyll, which absorbs light at blue and red wavelengths and transmits in the green. Particulate matter can reflect and absorb light, which reduces the clarity (light transmission) of the water. Substances dissolved in water can also affect its color.

Observations of ocean color from space, utilizing sensors specially designed to detect the small amount of light radiating from the sea surface, provide a global picture of the patterns of biological productivity in the world's oceans. For that reason, ocean color remote sensing data are a vital resource for biological oceanography. Unlike the limited area of the ocean that can be investigated from a research ship, data from a satellite sensor covers a large region and provides a comprehensive view of the marine environment.

The Goddard Earth Sciences Distributed Active Archive Center (DAAC) is the designated archive for all of the ocean color data produced by NASA satellite missions. The DAAC is a long-term, high volume, secure repository for many different kinds of environmental data. With respect to ocean color, the Goddard DAAC holds all the data obtained during the eight-year mission of the Coastal Zone Color Scanner (CZCS). The DAAC is currently receiving data from the Sea-viewing Wide Field-of-view

Sensor (SeaWiFS), and the MODIS-Terra instrument. The DAAC recently received reformatted data from the Ocean Color and Temperature Scanner (OCTS) and will also archive MODIS-Aqua ocean products.



SeaWiFS HRPT • Baja California • December 8, 2000

In addition to its archive and distribution services, the Goddard DAAC strives to improve data access, ease-of-use, and data applicability for a broad spectrum of customers. The DAAC's data support teams practice dual roles, both insuring the integrity of the DAAC data archive and serving the user community with answers to user inquiries, online and print documentation, and customized data services.

Coastal Zone Color Scanner (CZCS)

The Coastal Zone Color Scanner (CZCS) was a conventional multi-channel scanning radiometer deployed on the Nimbus-7 environmental satellite mission. CZCS operated from November 1978 to June 1986, and obtained more than 56,000 images of water-leaving radiances from the world's oceans, which were processed into images of phytoplankton pigment concentration. Four of the six CZCS spectral bands (or channels) were specifically for ocean color and had a 20nm bandwidth. Due to sharing of power with other Nimbus-7 instruments, the CZCS was operated on an intermittent duty cycle, so that the dataset represents only partial spatial and temporal coverage of the oceans. The eight-year mission of the CZCS represents the first instrumental remote-sensing observation of marine biological activity from space.

CZCS Browser: <http://daac.gsfc.nasa.gov/data/dataset/CZCS/index.html>

The Goddard DAAC holds the entire archive of CZCS Level 1, Level 1A, and Level 2 scenes, as well as Level 3 monthly composite images. All of the CZCS scenes can be ordered using the DAAC CZCS Data Browser, which formats data searches based on user-defined spatial and temporal search criteria and displays Level 2 browse images. Level 1 data are 1km resolution in CRTT format, which may be processed to Level 2 using the SeaWiFS Data Analysis System (SeaDAS). Level 1A and Level 2, 4km resolution, are available in DSP and HDF (the HDF data can be obtained directly by FTP). The Level 3 composites are in DSP format. All data can be obtained either by FTP or on tape (4mm DAT or 8mm Exabyte cassettes). In addition, the DAAC Interdisciplinary Data Collection archive possesses 1°x1° resolution monthly CZCS global composite data in binary format. The DAAC also features World Wide Web educational resources, print documentation, and access to CZCS-related software.

Sea-viewing Wide Field-of-view Sensor (SeaWiFS)

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) builds on the heritage of the CZCS mission. SeaWiFS is a dedicated global imager, observing over 90% of the oceans every two days at a resolution of 4.5 kilometers. Local receiving stations can receive SeaWiFS data for extensive regions of the ocean at a resolution of 1.13 km. With an improved signal-to-noise ratio, 10nm bandwidth, and two additional bands, SeaWiFS data allow improved atmospheric correction and more precise estimation of phytoplankton chlorophyll concentration. SeaWiFS data permit assessment of chlorophyll concentrations in both open ocean and coastal waters. SeaWiFS Level 3 global data provide a comprehensive and continuous view of oceanic biology and carbon cycling in the oceans. The SeaWiFS

Project has reprocessed the full mission data set four times to improve data quality, most recently in July 2002.

SeaWiFS Browser: <http://daac.gsfc.nasa.gov/data/dataset/SEAWIFS/index.html>

The GES DAAC archives all of the SeaWiFS Project standard data products, including Level 1A radiance and Level 2 geophysical products (4.5 km resolution), Level 1A High Resolution Picture Transmission (HRPT) station data (1 km resolution), Level 3 global data (9 km resolution), and ancillary meteorological and ozone data required for data processing. All products may be ordered using either the SeaWiFS WWW Data Browser or the SeaWiFS Data External Browser, a set of CD-ROMs containing SeaWiFS data browse images. The WWW browser features spatial, temporal, and attribute (cloud cover and ocean area) searching. SeaWiFS data are available either by FTP or on 4mm DAT or 8mm Exabyte tapes.

DAAC services for SeaWiFS data include data subscriptions and parameter subsetting. Data subscriptions allow automatic retrieval and delivery of user-specified data products (by FTP or on tape) as they are received from the SeaWiFS Project. Parameter subsetting allows users to select individual Level 3 binned geophysical parameters in lieu of an entire Level 3 binned data file. In addition to these services, the DAAC is responsible for insuring that access to SeaWiFS data for oceanographic research is restricted to SeaWiFS Authorized Users. (For information on how to become a SeaWiFS Authorized User, please contact the SeaWiFS Project.)

All volumes of the SeaWiFS Pre- and Postlaunch Technical Report Series may be ordered through the DAAC. The DAAC WWW pages also offer documentation; technical support; links to the SeaWiFS Project, SeaDAS, and other relevant sites; education and general information resources; and information regarding other ocean color satellite missions. The DAAC Ocean Color Data Support Team periodically distributes an electronic mail newsletter describing new features and developments.

Ocean Color and Temperature Scanner (OCTS)

The SeaWiFS and SIMBIOS Projects collaborated with the National Space Development Agency of Japan (NASDA) to produce OCTS data in the SeaWiFS Project data format. This data is available for November 1996 through June 1997, just three months prior to the SeaWiFS mission. The data is in Hierarchical Data Format (HDF) and is fully compatible with the SeaWiFS Data Analysis System (SeaDAS). Level 1A GAC, Level 2 GAC, and Level 3 data files corresponding to the SeaWiFS suite of geophysical products are available.

OCTS Browser: <http://daac.gsfc.nasa.gov/data/dataset/OCTS/index.html>

Moderate Resolution Imaging Spectroradiometer (MODIS)

The Moderate Resolution Imaging Spectroradiometer (MODIS) is a key instrument on the Earth Observing System (EOS) Terra and Aqua satellites, launched in December 1999, and May 2002, respectively. Data acquisition by MODIS-Terra began in February 2000 while MODIS-Aqua began in June 2002.

MODIS views nearly all of the Earth's surface every 1-2 days, in thirty-six visible and infrared (IR) spectral bands. Ocean color bands are 1 km resolution at nadir. MODIS also has IR sea surface temperature (SST) bands which are not discussed in this brochure. Global coverage at 1 km resolution, and the unique combination of simultaneous ocean color and SST information, make MODIS data invaluable for continuing studies of the marine biosphere from daily to decadal time scales and from regional to global spatial scales. Technological improvements provide MODIS-Terra with a higher signal-to-noise ratio than SeaWiFS, with extremely narrow bandwidth. MODIS-Aqua demonstrates even better performance with a reduction in optical

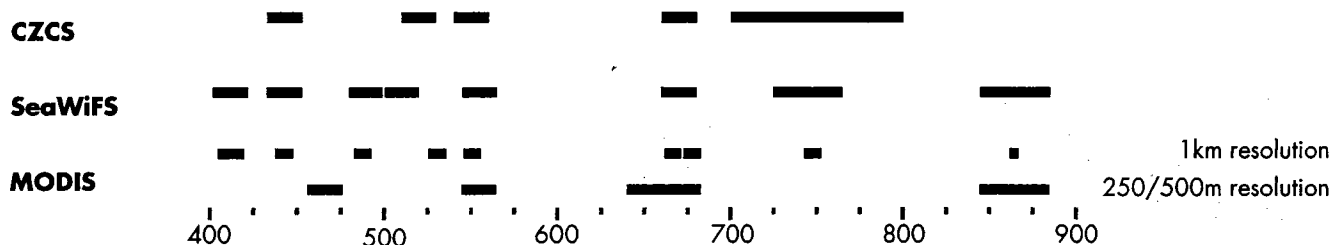
effects known in MODIS-Terra. Specific MODIS bands allow observation of chlorophyll fluorescence, which provides an indication of the physiological state of phytoplankton. MODIS data allow for a more precise determination of chlorophyll concentrations and light attenuation due to suspended matter in the water column, and the first routine quantification of light absorbed by phytoplankton. MODIS algorithms now calculate both weekly and annual ocean primary productivity. Currently, MODIS-Terra Ocean data have been reprocessed into the "Version 4" collection, which features high accuracy and significantly reduced variability. The 11 mm SST data from MODIS-TERRA has been validated and can be used for scientific research.

MODIS Information:

To help the user community acquire and understand MODIS data, find tools, navigate through numerous products to match the scientific and civic applications, the GES DAAC has established the MODIS Data Support Team (MDST).

<http://daac.gsfc.nasa.gov/MODIS/>

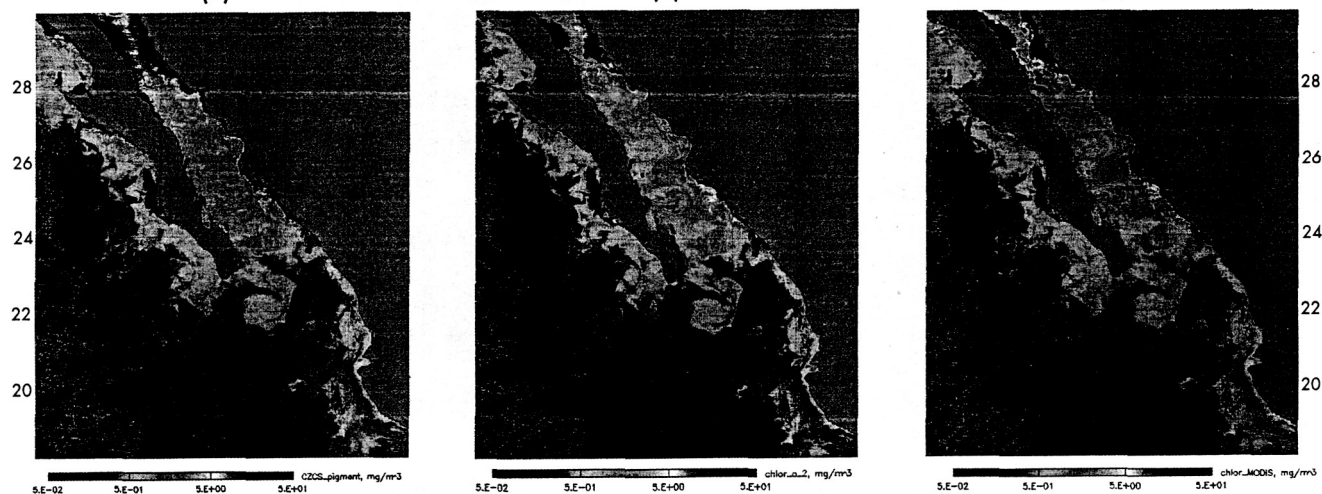
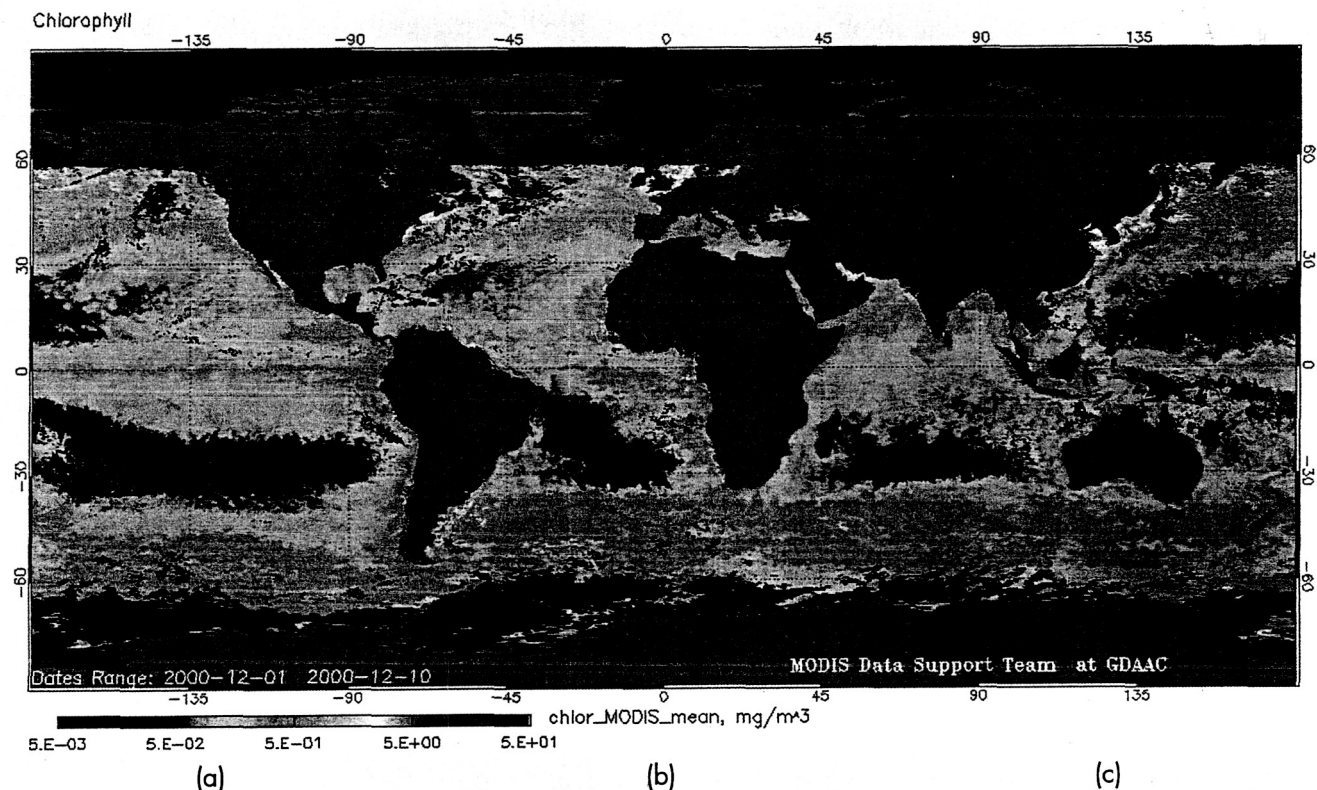
Instrument Comparison (Wavelengths and Bandwidths Relevant to Ocean Color, nm)



SeaWiFS Data Products

Parameter	Level
Raw radiance counts at 412, 443, 490, 510, 555, 670, 765, 865 nm	1A LAC/GAC
Calibration data, Instrument and spacecraft telemetry	1A LAC/GAC
Normalized water-leaving radiances at 412, 443, 490, 510, 555, 670 nm	2,3
Aerosol radiance at 865 nm	2
Angstrom coefficient 510-865 nm	2,3
Photosynthetically Available Radiation	3
Chlorophyll-a concentration	2,3
K(490)	2,3
Chlorophyll-a concentration:K(490)	3
Epsilon of aerosol correction at 765 and 865 nm	2,3
Aerosol optical thickness at 865 nm	2,3

Level	Spatial resolution	Temporal resolution	Data granule	Size
1A	1.13 km (LAC)	one pass	One downlink session	58-70 MB
1A	4.5 km (GAC)	one orbit (98.9 min)	One global (north-to-south) orbital swath	19.1 MB
2	4.5 km	one orbit (98.9 min)	One global (north-to-south) orbital swath	21.9 MB
3	9 km	Daily, 8-day, Monthly, and Annual	12 global equal-area grids, 1 corresponding metadata file	150 MB or 429.1 MB



Global chlorophyll_a concentration from the MODIS algorithm, upper panel. Lower images, related parameters in the waters of Baja Peninsula, December 3, 2000: (a) pigment concentration using CZCS algorithm, (b) chlorophyll_a concentration using SeaWiFS OC3M algorithm, and (c) chlorophyll_a concentration using MODIS algorithm. The MODIS-Terra Ocean Collection 4 data were used to derive all parameters. Compare these images to the December 8 chlorophyll image from SeaWiFS in the front page. These images demonstrate the usefulness of complementary data sets from ocean color sensors.

Level	Spatial Resolution	Temporal Resolution	Size	File Frequency
2	1km	5 minutes	33-102MB	144 or 288 files/day
3	4.63km, 36km, 1 degree	Daily, Weekly, Monthly, and Annually	0.1-865MB	1-40 files/period
4	4.63km, 36km, 1 degree	Weekly and Annually	0.3-1,360MB	1-10 files/period

The Goddard DAAC Ocean Color Panorama:

<http://daac.gsfc.nasa.gov/oceancolor/>

Email: ocean@daac.gsfc.nasa.gov OR daacuso@daac.gsfc.nasa.gov

The Goddard DAAC MODIS Data Support Team:

<http://daac.gsfc.nasa.gov/MODIS/>

Email: modis@daac.gsfc.nasa.gov OR daac_usg@gsfcsrvr4.gsfcmo.ecs.nasa.gov

Goddard DISC DAAC

Code 902

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